An efficient numerical solution of Hsu model involving size variation in soybean hydration

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An important step in the production of soybean-derived products such as soya milk is the soaking process. Even for fermentation of Soybean Meal (SBM), soaking is a necessary preconditioning step. Moisture hydration during soaking depends mainly on the time-temperature binomial. The amount of absorbed water increases as soaking time and temperature increase until it reaches a saturation limit. Both emprical and phenomenological models that represent hydration have been developed to predict the necessary time to obtain the desired moisture content at a certain temperature, representing the dynamic behavior of the soaking process. A distributed parameter phenomenological model knows as the Hsu model, which has effective diffusivity as its most important parameter, is used in this study. As the model involves nonlinear Partial Differential Equations (PDEs) which are inherently "stiff", it is usually difficult to solve them numerically. Hence the solution strategy often becomes a key factor in solving these PDEs. In this study, the Hsu model is solved using the Optimal Homotopy Analysis Method (OHAM) by considering both the variation in concentration and size. It is found that the approximations given by OHAM, with a couple of convergence-controlling parameters, converges fast in general. The variation in volume is solved using an appropriate numerical method. The analytical approximate solutions are then compared with the experimental data obtained from FTBE Department, Jadavpur University, Kolkata (India) and a good agreement between the experiment results and the simulation model was obtained.
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